CHAPTER 8

VACUUM SYSTEM

8.1 General

An existing vacuum facility is installed on the DØ detector platform which provides a utility vacuum header and an insulating vacuum header to the calorimeters on the platform. The utility header is used for general purpose vacuum pumping procedures such as pumping and purging. It is connected to a gas manifold that allows backfilling with low pressure dry nitrogen. The insulating vacuum header is a dedicated pumping path for the liquid argon calorimeter insulating vacuums. The magnet system and refrigerator can make use of either of the pumping headers keeping the intended purpose of each the same.

The vacuum pumps for the existing system are housed in a pump room that is accessible at all times. A portion of the current piping schematic showing these pumps is shown in Figure 8.1. The vane pumps [1] are double stage rotary vane vacuum pumps with a nominal pumping speed of 100 l/s. The blower [2] is a Roots-type pump with a nominal pumping speed of 500 l/s.

8.2 Insulating Vacuum

A simplified schematic for the solenoid vacuum system is shown in Figure 8.2 For initial cleanup and pumpdown of the magnet insulating vacuum or other operations where conditions would interfere with calorimeter insulating vacuum pumping, the utility vacuum header will be used. Pumpdowns from atmospheric will be throttled to prevent damage to multi-layer insulation in the control dewar vacuum space. For normal operations the insulating vacuum header will be used. After the control dewar and solenoid insulating vacuum is at the lowest attainable pressure it will be isolated. A turbomolecular pump will be provided between the isolation valve and the vacuum pumping system. The turbomolecular pump is mounted locally on the platform below the control dewar, outside the magnetic fields which could interfere with its operation.

The primary pumping path for the magnet insulating vacuum space is through the chimney in the clear space between the liquid nitrogen shield and the vacuum jacket. The effective pumping speed at the solenoid and control dewar are larger than that required to keep the solenoid operating should a small leak appear. The conductance of the pumping path was calculated for the free molecular flow regime and it was determined that for a turbomolecular pump with a nominal pumping speed of 1000 l/s, the effective pumping speed at the solenoid will be greater than 8 l/s. The required pumping speed at the solenoid to maintain the coil at 2×10^{-7} Torr with a warm 1×10^{-5} atm-cc/sec leak leaking cold **LHe** is 4 l/s.

8.3 Electrical Feedthroughs and Secondary Vacuum Container

Dielectric breaks in the form of ceramic electrical feedthroughs are required where the superconducting buses for the magnet penetrate the subcooler helium reservoir in the control dewar. A secondary vacuum container is provided to guard against unintended helium leaks in these rather fragile elements. A separate pumping line for this secondary vacuum container is provided which is independent from the system insulating vacuum. During initial pumpdown this line is connected to the inlet of the turbomolecular pump; during normal operation the secondary vacuum container is isolated. In the event of a small leak in one of the feedthroughs alternate pumping arrangements for the secondary vacuum container can be arranged.

References

[1] Edwards model E2M275, Edwards High Vacuum International, 301 Ballardvale Street, Wilmington, MA 01887

[2] Leybold Ruvac model SU2000, Leybold Vacuum Products, Inc. 5700 Mellon Rd, Export, PA 15632-8900

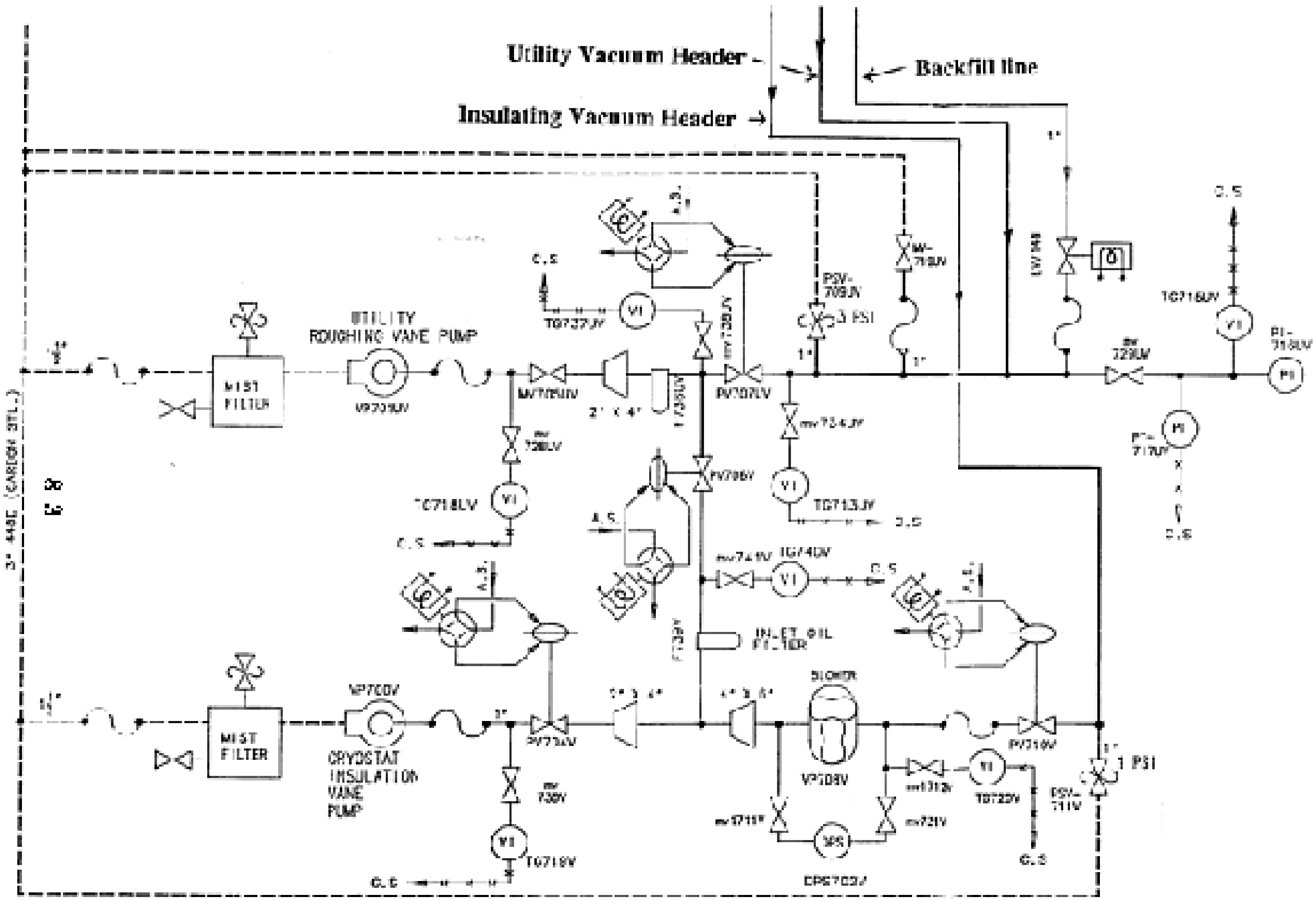

Figure 8.1 Schematic of existing Vacuum pumps

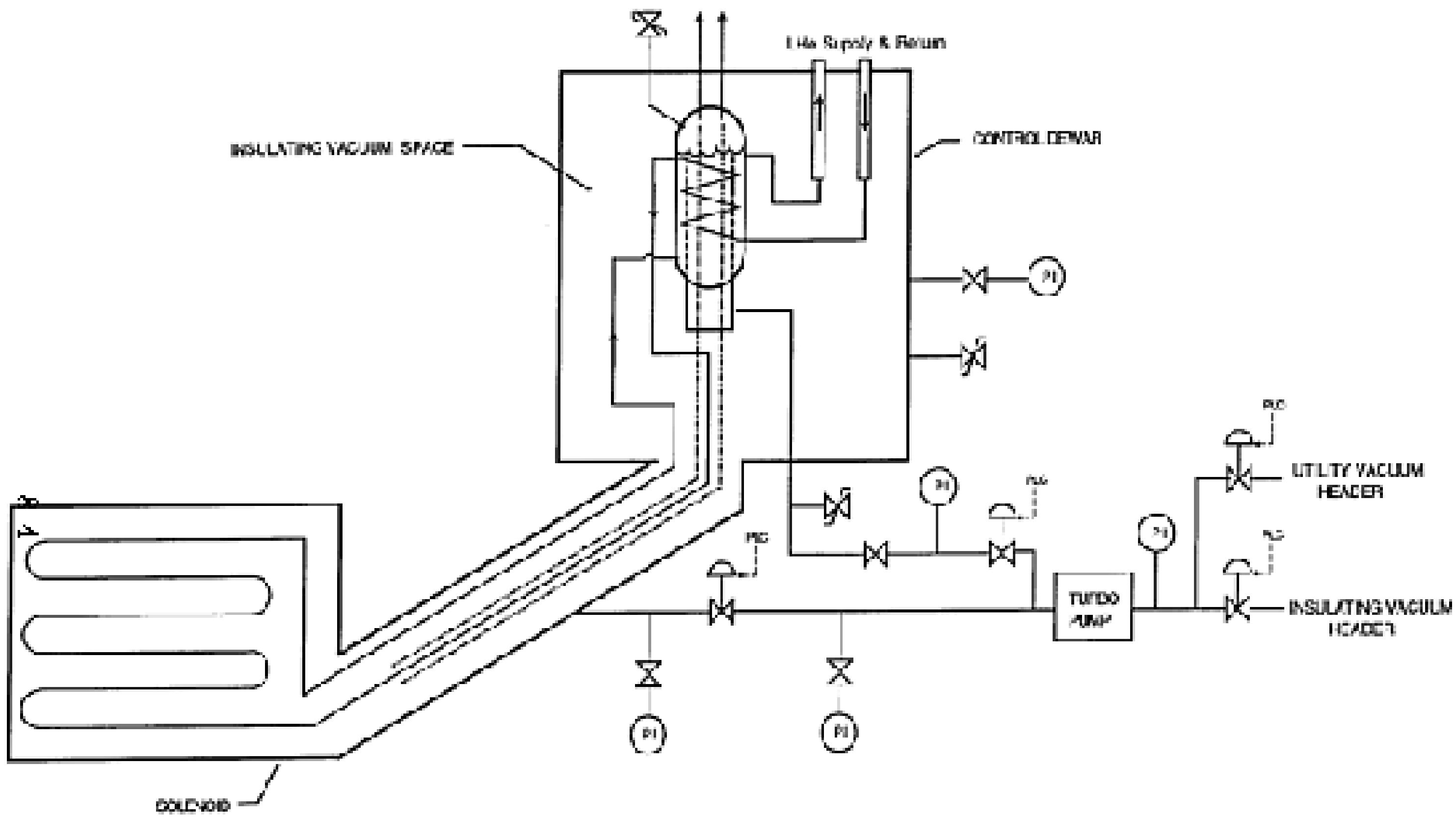

Figure 8.2 Simplified insulating vacuum system schematic